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Reply to Office Action of August 11, 2008
EKHAUS *et al.*
Appl. No. 09/887,528

Remarks

Reconsideration of this Application is respectfully requested.

Status of the Claims

Upon entry of the foregoing amendments, claims 1-19, 27 and 35-44 are pending in the application, with claims 1, 9, 10, 11, 35, 36, 41, 42, 43 and 44 being the independent claims. Claims 20-26 and 28-34 previously were cancelled. Claims 9, 10, 19, 27 and 35 previously were withdrawn from consideration in the present application pursuant to a restriction/election of species requirement. Claims 1, 8, 11, 18, 36 and 41 are amended herein. Claims 42-44 are newly presented.

Summary of the Office Action

In the Official Action, claims 1-8, 11-18 and 36-41 were rejected under 35 U.S.C. § 101, as allegedly directed to non-statutory subject matter, and claims 1-8, 11-18 and 36-41 variously were rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 6,049,777 ("Sheena") in view of Official Notice or in view of J. Schwinger, "The Geometry of Quantum States", Proceedings of the National Academy of Sciences of the United States of America, February 15, 1960 ("Schwinger").

Reconsideration and withdrawal of the rejections respectfully are requested in view of the above amendments and the following remarks.

Rejection under 35 U.S.C. § 101

The rejection of claims 1-8, 11-18 and 36-41 under 35 U.S.C. § 101, as allegedly directed to non-statutory subject matter, respectfully is traversed. In the Office Action, claims 1-8, 11-18 and 36-41 are alleged to be directed to non-statutory subject matter because they recite a method and "they are not tied to another statutory class and can be

performed without the use of a particular apparatus," and the claims "may be performed within the human mind" (see page 3 of the Office Action). Without conceding the propriety of the Examiner's characterization of the claims or the rejection, and solely to advance prosecution of the application to issue, independent claims 1, 11, 36 and 41 have been amended herein to include reference to particular apparatus/structure, as suggested by the Examiner. Support for these amendments may be found in the original application, e.g., in FIGs 4 and 5 and at page 21, line 20 through page 24, line 12. No new matter has been added.

Applicants submit claims 1, 11, 36 and 41 recite statutory subject matter. Claims 2-8, 12-18 and 37-40 depend from claims 1, 11 and 36, respectively, and are believed to recite statutory subject matter at least for the same reasons. Applicants respectfully request that the Examiner reconsider and withdraw the rejection.

Rejections under 35 U.S.C. § 103

The rejection of claims 1-7, 11-17 and 36-41 under 35 U.S.C. § 103(a), as allegedly unpatentable over Sheena in view of Official Notice respectfully is traversed.

<u>Claims 1, 11, 36, and 41</u>

Applicants submit that the cited combination of Sheena and "Official Notice" fails to disclose or suggest each and every limitation of independent claims 1, 11, 36 and 41. For example, in one aspect, claim 1 recites a method comprising, *inter alia*:

> *generating in memory a sparse **unary** ratings matrix from a user's selected preferences*, wherein said user's selected preferences are represented as binary data entries in said sparse unary ratings matrix, *wherein each binary data entry has a value of either zero or one*;
>
> forming a plurality of data structures representing said sparse unary ratings matrix; [and]

forming in a data processing device a runtime recommendation model from said plurality of data structures;

In another aspect, independent claim 11 similarly recites a method comprising, *inter alia*:

*generating in memory a sparse **unary** ratings matrix including ratings data represented as binary data entries, wherein each binary data entry has a value of either zero or one*;

forming a plurality of data structures representing said sparse unary ratings matrix; [and]

forming in a data processing device a runtime recommendation model from said plurality of data structures and said update ratings data structure;

In another aspect, independent claim 36 similarly recites a method comprising, *inter alia*:

receiving at the first recommendation system a runtime recommendation model from a second recommendation system, wherein the runtime model is formed from *a plurality of data structures representing a **unary** array of entries* that can be arithmetically manipulated, *wherein data in the unary array of entries is binary data, wherein each binary data entry has a value of either zero or one*, and wherein a majority of the entries in the array are zero;

In another aspect, independent claim 41 recites a method comprising, *inter alia*:

*retrieving a **unary** array of entries* that can be arithmetically manipulated, *wherein data in the unary array of entries is binary data, wherein each binary data entry has a value of either zero or one*, and wherein a majority of the entries in the array are zero; [and]

generating in a data processing device of the first recommendation system the recommendation model for a plurality of data structures representing the unary array of entries;

(emphasis added).

Applicants' specification defines and explains certain terms recited in the claims.

In particular, the specification defines and explains the term *ratings matrix* as follows:

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As used herein, a *ratings matrix* is a collection of numerical values indicating a relationship between a plurality of clients and a plurality of items. In general, and as indicated earlier, one may denote this as:

$\mathbf{R} = \mathbf{R}_{u,i} =$ { 1 : if client u votes favorably for item i / 0 : otherwise

Where $u \in U$, the set of all clients, and $i \in I$, the set of all items. One skilled in the art should appreciate that "votes favorably" as use above may correspond to a variety of acts. For example, a favorable vote may correspond to client u purchasing item i, or it may correspond to client u literally expressing a favorable interest in item i. Again, item i itself is not limited to goods but may also correspond to services.

(see page 9, line 10 to page 10, line 1; emphasis in original).

The specification defines and explains the term *unary data* as follows:

As used herein, *unary data* indicates a ratings data in which there are only two types of information: *positive* and *no information*. Such data sources are usually encoded with rating values of either zero or one. It is customary to let zero express *no information* since such use produces a sparse data set. (see page 12, emphasis in original).

In each aspect presented above (claims 1, 11, 36, 41), the claim recites a *sparse unary data structure or matrix* in which each ratings data entry is either a binary "0" or "1".

As explained in greater detail in the present application, data structures and matrices that are unary in nature may provide a number of advantages over non-unary data structures and matrices. For example, unary data structures and matrices may be populated as a direct result of binary decision trees from which the data structures are built. Also, as explained in the present application, in view of the large volume of ratings data collected by clients engaged in E-commerce, it may be advantageous to use sparse, unary matrices in order to allow rapid processing of large ratings matrices (see page 4, lines 1 to 9, page 18, lines 3-13, page 42, lines 10-13, and page 60, line 20 to page 61, line 4). For example, those skilled in the art would appreciate that use of the

claimed sparse unary ratings data would allow runtime recommendation models to be formed on data processing devices that have inherently constrained resources, such as small personal digital assistants (PDAs) or other wireless devices (see page 47, lines 4-18, page 57, lines 16-19, and page 62, lines 10-20). Further, as explained in the present application, the use of unary matrices may provide an additional advantage in the preservation of data privacy, as originally-entered ratings data cannot be reconstructed from unary matrices containing binary ratings values of either "0" or "1" (see page 4, lines 10 to 13 and page 52, line 15 to page 53, line 6).

Applicants submit that Sheena fails to disclose or suggest at least the above-described features of the claims. In particular, in contrast to the above-described features of claims 1, 11, 36 and 41, Sheena teaches a system and method that builds data structures that are not unary in nature, as described in the present application and recited in claims 1, 11, 36 and 41.

Sheena relates to a computer-implemented collaborative filtering based method for recommending an item to a user, and discloses a collaborative filtering based recommendation system and method that generates/uses a rating matrix comprising "user profiles" and "user profile data" together with "item profiles" and "item profile data". Each user profile associates items with the ratings given to those items by the user, and the form of the user profile may be any data construct that facilitates such associations, such as an array, although Sheena states that it is preferable to provide user profiles as sparse vectors of n-tuples, where each n-tuple contains at least an identifier representing the rated item and an identifier representing the rating that the user gave to the item, and may include any number of additional pieces of information regarding the item, the

rating, or both. (see, e.g., column 3, lines 33-48). However, Applicants submit that

Sheena fails to disclose or suggest at least the above-discussed features of the subject

claims, including at least the feature of a sparse unary rating matrix or data structure.

Rather, Sheena teaches a system and method that uses subjective ratings values selected

from within a range of values. Specifically, Sheena states:

> Ratings for items which are received from users can be of any form that allows users to record *subjective impressions* of items based on their experience of the item. *For example, items may be rated on an alphabetic scale ("A" to "F") or a numerical scale (1 to 10).* In one embodiment, ratings are integers between 1 (lowest) and 7 (highest). ...
>
> Ratings can be inferred by the system from the user's usage pattern. For example, the system may monitor *how long* the user views a particular Web page and store in that user's profile an indication that the user likes the page, assuming that *the longer the user views the page the more the user likes the page.* ...

(see, column 4, lines 21-55; emphasis added).

That is, Sheena teaches a system in which ratings are values selected or inferred

from a range of values or scale representing a subjective impression of the item.

In this regard, Applicants respectfully submit that the Examiner's characterization

of column 8, lines 41-46 of Sheena is misleading and, when viewed as a whole,

erroneous. The Examiner identifies this portion of Sheena as disclosing the feature of

"using 1 to indicate that a user has rated the item and 0 to indicate that a user has not

rated the item" (see page 9 of the Office Action). Applicants submit that the Examiner's

statement is taken out of context and thereby misleading. The cited portion relates to the

calculation of "similarity factors," which express the degree of correlation between two

user's profiles for a particular set of items. Sheena describes various methods and

corresponding equations for calculating such correlations, including the portion cited by

the Examiner, as follows:

In the following description of methods, D_{xy} represents the similarity factor calculated between two users, x and y. ***H_{ix} represents the rating given to item i by user x***, *i* represents all items in the database, and *c_{ix} is a Boolean quantity which is 1 if user x has rated item i and 0 if user x has not rated that item.*

(column 8, lines 41-46 cited by Examiner; emphasis added).

As clearly stated by Sheena, H_{ix} represents the rating, not c_{ix}; nowhere does Sheena disclose or suggest that such rating H_{ix} is a unary rating, i.e., a rating of binary "0" or "1." Rather, Sheena merely teaches that a Boolean quantity c_{ix}, which has a value of "0" or "1," based on whether the user has given a rating for an item, is used in a particular equation *with the ratings* for the items to determine the similarity factor between users' profiles for a particular set of items. For example, in one method for determining the similarity factor, Sheena teaches the equation:

$$D_{xy} = \frac{\sum_{i \in I} c_{ix} c_{iy} (H_{ix} - H_{iy})^2}{\sum_{i \in I} c_{ix} c_{iy}}$$

(column 8, lines 58-63).

Nowhere is Sheena understood to disclose or suggest at least the feature of generating or receiving a sparse unary ratings data structure or matrix including ratings data represented as binary data entries, wherein each binary data entry has a value of either "0" or "1", as variously recited in claims 1, 11, 36 and 41.

In the Office Action, the Examiner acknowledges that Sheena fails to disclose these features of the claim, but asserts that such features do not establish patentability. Specifically, the Examiner states:

> Sheena does not teach where each binary data entry has a value of either zero or one. However, the recited method steps would be performed the same regardless of

the specific data. Further the structural elements remain the same regardless of the specific data. Thus, the descriptive material will not distinguish the claimed invention from the prior art in terms of patentability (citing *In re Gulack, In re Lowry* and MPEP § 2106).

(page 5, last paragraph).

Applicants agree with the Examiner's first statement - that Sheena does not teach where each binary data entry has a value of either zero or one.

Applicants submit that the remaining statement is unsupported, inapposite and/or erroneous. Initially, the Examiner has made no showing that Sheena performs "the [same] recited method steps." In particular, Applicants submit that, since Sheena does not generate a sparse unary ratings matrix or data structure (0,1), as claimed (as acknowledged by the Examiner), each further process of the claims in the present application using such sparse unary ratings matrix or data structure is different and produces a different result than Sheena. Further, Applicants submit that the claimed sparse unary matrix or data structure process is not merely non-functional descriptive material, such as music, a literary work or a compilation or mere arrangement of data, as suggested by the Examiner. Rather, Applicants submit that claims 1, 11, 36 and 41 recite functional descriptive material (data structures) that is recorded and/or processed, and thereby interrelated with structure such that it may be realized. As such, the claimed sparse unary rating data structures distinguish the claims over the prior art in terms of patentability. (see *In re Gulack, In re Lowry*, MPEP 2106 cited in the Office Action).

Finally, the Examiner's characterization, assertion and reliance on Official Notice in combination with Sheena respectfully is traversed. In the Office Action, the Examiner states:

Official Notice is taken that entering a 0 or 1 for selecting a choice is old and well known in the art *and* in combination with the teachings of Sheena would have been

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obvious to one of ordinary skill in the art at the time of the invention by producing a predictable result in combination with the teachings of Sheena regarding providing ratings. (italics emphasis added)

Without conceding the propriety of the Examiner's characterization of what is old and well known in the art, Applicants submit that the Examiner has failed to make a proper showing that it would have been obvious to one of ordinary skill in the art at the time of the invention to have combined such knowledge ("entering a 0 or 1 for selecting a choice") with the teaching of Sheena to achieve the claimed method, as recited in any of claims 1, 11, 36 and 41.

Applicants submit that merely "entering a '0' or '1' for selecting a choice" does not, *per se*, constitute "entering a *rating* of an item." Thus, nowhere does either the asserted "Official Notice" or Sheena teach entering a "0" or "1" for generating a rating used in a unary ratings matrix or data structure, wherein the rating is a binary "0" or "1".

Further, neither Sheena nor such "knowledge" provides any motivation, reason or basis to combine such "knowledge" ("entering a '0' or '1' for selecting a choice") with the teaching of Sheena so as to substitute such knowledge - entering a "0" or "1" - for the described process of entering non-binary alphabetic ("A" to "F") or numerical (1-10) ratings scales in a ratings matrix or data structure. In particular, Applicants submit that generating a sparse unary ratings matrix from a user's selected preferences, wherein said user's selected preferences are represented as binary data entries in said sparse unary ratings matrix, was not well known in the art at the time of the invention. Applicants further submit that retrieving and representing a unary array of entries that can be arithmetically manipulated, wherein data in the unary array of entries is binary data, wherein each binary data entry has a value of either zero or one was not well known in the art at the time of the invention.

Applicants further submit that it would not have been obvious to one of ordinary skill in the art at the time the invention was made to modify Sheena to achieve the claimed subject matter of the present application. For example, claim 1 recites a method of preparing a recommendation, including "generating a sparse unary ratings matrix from a *user's selected preferences*" (emphasis added). That is, the ratings matrices and arrays recited in claims 1, 11, 36 and 41 are built from binary user inputs, such as purchasing decisions and expressing a favorable interest in items (page 9, lines 14-17). Sheena characterizes such a system as "content-based filtering," wherein "the content-based filter selects items ... based upon correlations between the content of the item and the user's preferences," and "the items to be selected must be in some machine-readable form" (Sheena, col. 1, lines 49-55). Sheena criticizes such content-based filtering systems/methods and teaches that they are unsatisfactory. In particular, Sheena states that "even the best content-based filtering schemes cannot provide an analysis of the quality of a particular item as it would be perceived by a particular user" (Sheena, col. 1, line 66-col. 2, line 2). Further, Sheena concludes that a content-based filtering scheme "generally cannot further refine the list of selected items" (Sheena, col. 2, lines 4-6). Sheena thus teaches away from using a content-based filtering system or method, as recited in claims 1, 11, 36 and 41.

As Sheena teaches away from this feature recited in claims 1, 11, 36 and 41, Applicants submit that it is improper to combine Sheena and Official Notice to establish a *prima facie* case of obviousness. See, M.P.E.P. §§ 2141.02 and 2145(X)(D)(2); *In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988); *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 796 F.2d 443, 230 U.S.P.Q. 416 (Fed. Cir. 1986) (stating a reference should be

considered as a whole, and portions arguing against or teaching away from the claims

much be considered); *Gillette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720, 16

U.S.P.Q.2d 1933 (Fed. Cir. 1990) (stating the closest prior art should not be used

because the closest prior art "would likely discourage the art worker from attempting the

substitution suggested by the [inventor/patentee]."); *In re Gurley*, 27 F.3d 551, 31

U.S.P.Q.3d 1130 (Fed. Cir. 1994) ("A reference may be said to teach away when a

person of ordinary skill, upon reading the reference, …would be led in a direction

divergent from the path that was taken by the applicant."); *In re Geisler*, 116 F.3d 1465,

1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997) (stating a prima facie case of obviousness

may be rebutted by showing that the art, in any material respect, teaches away from the

claimed invention).

For at least these reasons, independent claims 1, 11, 36 and 41 are allowable over

Sheena and "Official Notice."

Claims 2-7, 12-17 and 37-40 depend from claims 1, 11 and 36, respectively, and

are believed allowable for the same reasons. See, *In Re Fine*, 837 F.2d 1071 (Fed. Cir.

1988), and M.P.E.P. § 2143.03. Moreover, each of these dependent claims recites

additional features in combination with the features of its respective base claim and is

believed allowable in its own right. Individual consideration of the dependent claims

respectfully is requested.

<u>Claims 8 and 18</u>

The rejection of claims 8 and 18 under 35 U.S.C. § 103(a), as allegedly

unpatentable over Sheena in view of Schwinger respectfully is traversed. The Examiner

concedes that Sheena does not disclose a mapping step comprising multiplying unary

ratings matrices by a mappings matrix between said unary ratings matrices and a

plurality of categories, as recited in claims 8 and 18 (see page 9 of the Office Action),

but asserts that Schwinger remedies this deficiency. Without conceding the propriety of

the Examiner's characterization of Schwinger, Applicants submit that Schwinger fails to

remedy at least the above-discussed deficiencies of Sheena, and fails to add anything to

Sheena that would have made obvious the claimed invention.

Further, as discussed above, as Sheena teaches away from a method as recited in

claims 1, 11, 36 and 41, Sheena cannot be used in combination with Schwinger to

establish a *prima facie* case of obviousness.

Newly Presented Claims 42-44

Newly presented claims 42-44 have been added to provide Applicants with

additional scope of protection commensurate with the disclosure. Newly presented

claims 42-44 recite features similar to features of claims 1, 11, 36 and 41, as discussed

above, with respect to a data processing device (claims 42, 43) and a computer program

product (computer readable storage medium claim 44), and are believed allowable for at

least the same reasons. Support for these new claims may be found in the original

application, e.g., in FIGs. 5 and 6-9 and at page 22, line 20 through page 23, line 14. No

new matter has been added.

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Conclusion

Applicants believe that the present Amendment is responsive to each of the points raised by the Examiner in the Official Action, and submit that the application is in condition for allowance. Favorable consideration of the claims and passage to issue of the application at the Examiner's earliest convenience earnestly are solicited.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Respectfully submitted,

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